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THE ORIGIN OF PETROLEUM—I*

By F. MORTON† (Vice-President)

Despite the importance of petroleum and the many investigations and theories concerning its origin very little is known with certainty. This is because petroleum is a fluid and capable of movement so that the reservoir rocks in which it is found may not be the rock in which the oil was formed. This uncertainty concerning the source rocks of petroleum has made the study of the origin of petroleum difficult and at the same time offered scope for innumerable theories based on the lack of positive evidence.

*Lecture delivered to the Stanlow Branch, March 21, 1951.

†Dept. of Chemical Engineering, University of Birmingham.

In recent years there has been considerable research into the constitution of petroleum and although a great deal is now known concerning the nature of the hydrocarbons which constitute the gasoline and kerosine fractions of several petroleums, this has to some extent complicated the picture for it now appears that petroleum may vary in its composition over very wide ranges of physical and chemical character.

Although the majority of the theories advanced during the past fifty years to account for the origin of petroleum are now of historic interest only and have little bearing on the modern theories on this subject, a brief historical survey is of interest as showing the necessity of a

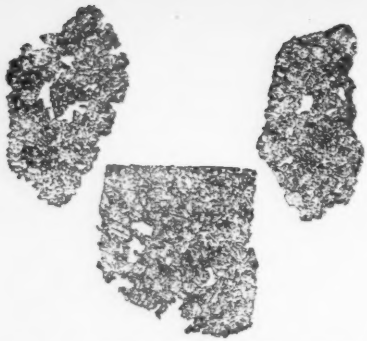

Fig. 1. Enlarged sections of Trenton limestone showing nature of pores. (After Orton.)

combined approach of the respective sciences to this particularly difficult problem.

Petroleum and natural gas occur in sedimentary beds. There are several instances of commercial production from igneous rocks but in all cases the oil is believed to have originated in adjacent sedimentary rocks and to have migrated to the igneous rock which has acted merely as a reservoir. Petroleum is normally found in sands and sandstones associated with clays or shales, or in porous limestones and dolomites, and occupies the space between the grains of sand or fills the pores and cracks in the limestone. The pore space may constitute from 1 to 30 per cent of the rock. Typical sections of an oil-bearing limestone are shown in Fig. 1. Usually the oil occurs in the anticlinal fold of the structure, but it is also found in inclined structures sealed at the upper end by any of several means. Usually the gas, oil, and water separate by gravity into three layers, but not all commercial pools have gas caps or active water drives.

Typical modes of occurrence of oil are shown in Figs 2 and 3. Fig. 3 represents a cross-section through a salt dome. Here three types of oil reservoirs are shown, (a) the typical anticlinal accumulation, (b) the sealed or pinched out stratigraphical trap, and (c) the fault trap. In each case, however, the oil-bearing strata must have an impermeable cover, the cap rock, to prevent the escape of oil. When the oil-bearing formation has been drilled and the well is producing, the oil flows to the well casing by pressure differences caused by the gas in solution being released (solution gas drive), the expansion of the high pressure gas above the oil level (gas cap drive) or the sweeping in of the edge water which invades the oil-bearing strata as the oil is removed (active water drive). When the gas

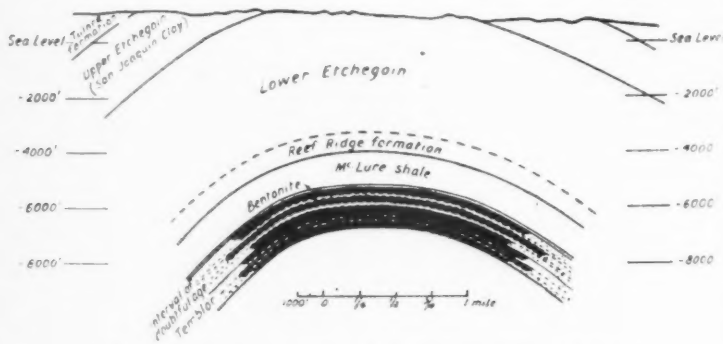

Fig. 2. Ideal cross-section through the Kettleman Hills north dome.

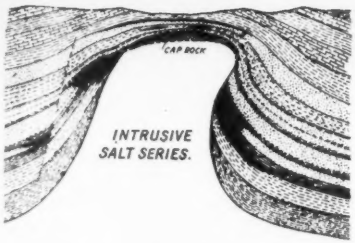

Fig. 3. Diagrammatic cross-section through a salt dome. The three sites of oil accumulation associated with salt domes are illustrated. In addition there is trapping due to uncomformable conditions, and the highly disturbed nature of the structure near the flanks of the salt intrusion leads to considerable faulting, and such faulting produces further local oil accumulation.

drive begins to loose its pressure differential the well may be further produced by pumping.

The first theories advanced to account for the formation of petroleum were inorganic. Berthelot in 1866 suggested that mineral oils were formed by the action of water on metallic carbides such as calcium and iron carbides. In addition to the possible formation of oils by polymerization of acetylene Berthelot had been able to demonstrate that iron carbide when treated with water did give rise to hydrocarbons not unlike those present in crude petroleum. The presence of iron carbide in meteorites was considered by Berthelot to be evidence in support of his theory that such carbides would be present in the earth. Mendeleef, about the same time, showed that the action of carbon dioxide and water upon the alkali metals sodium and potassium gave small quantities of hydrocarbons and therefore suggested this as a possible means of formation of petroleum.

Neither carbides nor alkali metals are known to exist in the earth's crust, but if they do exist they can only do so at the high temperatures associated with volcanic phenomena. Since the greater part of the earth's oilfields are not associated with such phenomena and indeed, some of the largest oilfields are very far removed from any centre of igneous activity, the theories were never seriously accepted by geologists and indeed Höfer in his classic examination of these views had reduced them to absurdity. Nevertheless because of the reputations of the authors the theories were long considered tenable by chemists.

The possibility that petroleum was derived from organic material, such as the remains of plants and animals, buried in the sea has always been favoured by geologists, possibly in the first case because oilfield waters are almost always brine—although of somewhat different composition from the present sea water, but the mechanism by which such deposits could be converted into petroleum has been the subject of much speculation and dispute. The theory that petroleum was formed by the distillation of organic matter was first suggested by Newberry and Orton. Later, Day and subsequently Engler obtained paraffin hydrocarbons by the laboratory distillation of vegetable oils and fish oils, etc., and the theory that petroleum was formed from animal remains by such a distillation process was developed by Engler and supported by Höfer.

It is again apparent, from the many geological surveys published during the period that the Engler-Höfer theory held sway, that geologists were never very happy about this theory simply because it required the application of a temperature not normally met in oil reservoirs. To produce oil by the distillation of the calcium salt of a fatty acid, or by distillation of organic sediments, requires a temperature above 350°C and probably nearer 450°C. The normal increment of heat in the earth's crust is about 1°C for every 100 feet so that even at a depth of two miles the temperature of the sediment would only be raised by 100°C. Although several other

objections to the Engler theory have been made the temperature required for the distillation led to it being finally rejected. Even if the theory were tenable on geological grounds, the presence of certain porphyrin derivatives known to decompose at temperatures in excess of 200°C and the presence of optically active constituents indicate the low temperature origin of petroleum.

The possible similarity between the origin of coal and petroleum has naturally attracted attention and several investigators, notably David White (1916) and Cunningham Craig (1912) have suggested that oil and coal are derived from similar source materials. The association of certain oil-producing strata with lignitic beds in certain parts of Europe and America led White to compare the geological occurrence of coal and oil and to suggest that both were derived from similar source materials, but that subsequent effects of heat and pressure resulted in certain cases in coal and in others in the formation of oil. The fact that coal has been formed in the main from vegetable matter deposited in fresh water, whereas the bulk of the oilfields are associated with salt water and hence by inference with marine deposition, made White's views unacceptable to many geologists. Although the theory was given very serious consideration it is no longer considered adequate.

Out of the various discussions and theories of the period 1900 to 1930 there arose a body of evidence to suggest that petroleum was formed by the decomposition of plant and animal remains that had been buried with sedimentary rocks, and that the original deposition of the organic material had taken place under marine or brackish water conditions.

The means by which the organic matter was converted into petroleum was unknown, although the general opinion appears to have favoured the action of some kind of anaerobic bacteria. Anaerobic conditions were believed essential if any sizable accumulation of organic debris on the sea floor was to escape the normal scavenging of deep sea life. The type of sedimentation, the amount of organic material and the time and depth of burial needed to ensure the formation of petroleum were subjects of general speculation, but no single unified theory had been advanced until the publication by Krecji Graf of his studies of the relationship between crude oil and stratigraphy in the Roumanian oilfields. Krecji Graf showed that in Roumania the oils in the younger strata were normally naphthenic in character, but as the depth of the deposit and its geological age increased the oils became increasingly paraffinic, and lighter. He therefore suggested that petroleum was formed from richly organic source beds, such as the type now met with in the Black Sea, containing above 30 per cent of organic matter and that temperatures and pressures compatible with a minimum depth of burial of 4000 metres were necessary to convert this material into a "proto-petroleum." The proto-petroleum was believed to be paraffinic but as it migrated upwards it was changed by various reactions into petroleum of increasingly naphthenic character.

This theory attracted considerable attention. Many petroleum geologists accepted the theory completely, some accepted the general theory of deep burial, but believed the proto-petroleum should be asphaltic in character rather than paraffinic, whilst others considered the occurrence of the richly organic deposits of the euxinic (or sapropelletic) type to be so rare as to preclude their being the normal type of deposit leading to petroleum formation. There was also a belief among many geologists that deep burial was not necessary but that on the contrary petroleum could be formed from shallow depth deposits

and this in turn necessitated the assumption of a relatively rapid rate of formation of petroleum at low pressures and moderate temperatures.

D. C. Barton made an extensive study of the relationship between crude oil character and stratigraphy in the Gulf Coast oilfields of the U.S.A. using the gravity interval method of plotting the U.S. Bureau of Mines distillation analysis of crude oils and concluded that the nature of an oil was related to the depth of burial, but he did not agree that the younger oils were formed from the older and deeper oils. He considered that similarities in oils of different areas or of differing stratigraphical horizons in the same area were an indication of similar source materials and similar histories. Hans Hlauschek extended Krecji Graf's studies to include the analysis (in terms of paraffinic and naphthenic oils) of oils from many parts of the world in order to examine the relative merits of the two opposing theories. It is interesting at this stage to repeat Hlauschek's point by point analysis of the fundamental inferences of each theory.

The Deep Burial Theory, based upon the view that petroleum is formed at great depth and moderately high temperatures, requires the following assumptions:—

1. That the formation of petroleum is an extraordinary—or only rarely occurring—process.

2. The only source rocks which can be considered are certain rare sediments (sapropelletic) which are distinguished in many ways from the more common sediments and particularly by an extraordinary high content of organic matter.

3. The conversion of the source material into petroleum is only possible at temperatures above 150°C which by ordinary geothermal relationships requires a depth of not less than 4000 metres.

4. The so-formed petroleum consists essentially of hydrocarbons of the paraffin series.

5. The petroleum migrates upwards to zones of lower pressure.

6. The migration is generally by open clefts.

7. The migrating oil penetrates into suitable porous rocks and forms in these reservoir rocks secondary deposits.

8. In the region of normal temperature rises (1°C and 33m) and normal layering (with due allowance for faulting, slipping and erosion, etc.) all sediments and deposits of less than 4000 metres depth are of secondary nature.

9. The chemical variety of such oils is essentially due to physical and chemical influences during the geological history. Differences in source material are not considered of importance since the "proto-petroleum" was originally paraffinic.

10. The naphthenic oils have been formed from the paraffinic oils during the migration or by surface action (catalytic).

The Shallow Depth of Burial Theory, in direct contrast, postulates the following points:—

1. The formation of petroleum is a common process which under certain definite conditions can be repeated in the same place (i.e. in several overlying layers and formations).

2. All marine and brackish water clays and marls are considered possible source rocks. Under certain circumstances fine sands, dolomites and chalk may be source rocks particularly, if they have a higher content of organic matter than the average. An organic content of 4-8 per cent, in contrast with the average organic content of 1.5 per cent would apparently lead to the formation of significant oil strata.

3. The conversion of the source material to petroleum occurs at depths not greater than 1500 metres and at temperatures considerably below 100°C.

4. The chemical character of the oil is dependent upon the nature of the source material and upon the chemical, physical, and biological relationships

during and immediately after the transformation.

5. Petroleum has a general tendency to migrate upwards, but the migration of large quantities of petroleum across considerable strata seldom occurs and is not the general rule.

6. Any migration over considerable distance is usually by open clefts.

7. The migrating oil enters into suitable reservoir rocks and forms in these reservoirs deposits which are designated as primary if the source rock is immediately neighbouring and as secondary if a large stratigraphical distance lies between them.

8. If several oil deposits occur one above the other then it is possible—indeed probable—that one or more are primary in the above sense.

9. The physical characteristics of the oil can be altered during the geological history within certain limits. The chemical character is less likely to be altered and differences in chemical nature of oils are due in the main to differences in source material and differences in sedimentary environment.

10. The preponderance of paraffins (paraffin base), or alternatively, of naphthene hydrocarbons (naphthenic base) is an unalterable property and is therefore a suitable criterion for identification. Paraffins and naphthenes cannot as a rule be derived one from the other and are derived independently of each other.

Hlauschek took the view that the conversion of paraffinic hydrocarbons into naphthenes was a necessary constituent of the deep burial theory and therefore a logical basis upon which to attempt a proof or otherwise of the theory. In support of the deep burial theory was the fact that in petroliferous provinces containing several oil-producing horizons the shallower oils were normally more naphthenic than the deeper oils, although exceptions were known. Despite this Hlauschek did not consider that under normal conditions paraffinic oils could be converted to naphthenic oils. Laboratory work has since shown that the conversion of paraffins to aromatic hydrocarbons and thence by hydrogenation to derivatives of *cyclo*hexane is possible but the conditions are such as to preclude the reaction being responsible for the change of oils.

The controversy concerning these two theories resulted in a renewed attack on the problem. In the laboratory, Berl obtained petroleum-like mixtures from the treatment of cellulose materials in the presence of aqueous alkalis and he supported the deep burial theory, but believed the proto-petroleum to be asphaltic in character—a view supported by Brooks. Strangely enough the geologists were not particularly interested in the chemical nature of the evidence. The question of whether or not paraffins could, or could not, be converted to naphthenes was of little importance as compared with the more important problems of source material, sedimentary conditions, environment, and migration. Reference to many of the geological writings, particularly to the replies to the questionnaire of Parker and Van Tuyl on the "Time of Origin and Accumulation of Petroleum" suggests that many geologists believed that, since conditions had existed in which organic material had been converted into a variety of petroleums, there was reason to assume that other conditions might have existed capable of transforming one type of petroleum into another. In particular migration of oil across formations containing certain clays, etc., could, presumably by catalytic action, bring about reactions of polymerization or depolymerization and by adsorption and other means the relative quantities of paraffins, naphthenes, and aromatic hydrocarbons could be altered to produce the types of oils found in various provinces. Reactions such as the action of sulphur, hydrogenation by methane, the effect

of bombardment by α particles and many others, have been suggested to account for the alteration of oils either during migration or during the period in the reservoir rock. More recently the catalytic action of various earths which may bring out rearrangement of hydrocarbons by carbonium-ion mechanisms have been suggested as a means whereby oils can be converted from one type into another. Thermodynamic studies (1933) have indicated that "cracking" reactions are unlikely to have been possible at the low temperatures postulated (not above 150°C) within geological time unless assisted materially by catalytic, or other effects.

All these various theories the geologist has considered as useful contributions to the subject and has attempted to fit them into the framework of the known geological facts. Only one thing is asked of the physicist or chemist who proposes a theoretical path from a known starting material (cellulose, sterols, proteins, etc.) to a petroleum-like mixture of compounds. That is that the steps in his reaction mechanism shall comply with these facts: that the source material was laid down in marine or brackish water sediments, that the petroleum has almost certainly been in direct contact with brine or water wet clays and sands throughout its history, that its temperature has probably never exceeded 150°C (as shown by the presence of chlorophyl porphyrins and by the retention of optical activity), and that petroleum as it occurs in the reservoir does not contain any olefins. Mechanisms which postulate decarboxylation of organic acids by heat, or the catalytic effect of anhydrous hydrofluoric acid or other agents such as aluminium chloride, or which postulate reactions based on olefinic intermediates are not acceptable.

★ ★ ★

LABOUR STATISTICS FOR THE U.K. PETROLEUM REFINING INDUSTRY

The following figures are taken from the March 1952 issue of the *Ministry of Labour Gazette*.

(Cf. previous figures given in the *IP Review* (1952, **6**. 10).)

Figures in bold type are the averages for all the industries covered by the tables.

	Men (21 and over)	Youths and Boys	Women (18 and over)	Girls	All Workers
No. of wage-earners covered by remuneration statistics ...	10,754	608	606	10	11,978
Average earnings in last pay-week in October, 1951 ...	180/6 **166/0**	74/3 **69/1**	99/6 **90/1**	— —	170/11 **141/1**
Average number of hours worked in this pay-week ...	47.9 **47.8**	44.5 **44.5**	42.9 **41.5**	— —	47.5 **46.1**
Average hourly earnings in this pay-week (pence) ...	45.2 **41.7**	20.0 **18.6**	27.8 **26.0**	— —	43.2 **36.7**
			Males	Females	
Numbers employed (January 1952)			25,000	4,700	29,700
Numbers unemployed (at February 11, 1952)			340	40	380
Labour turnover rate (6 weeks ended January 5, 1952)					
No. of engagements per 100 employed			1.6 **2.6**	1.3 **3.1**	1.5 **2.8**
No. of discharges and other losses per 100 employed ...			1.8 **2.6**	2.4 **4.8**	1.8 **3.3**

COUNCIL COMMENTARY

The monthly meeting of Council was held on March 12 with Professor F. Morton, vice-president, in the chair, the President being out of the country.

The Covenant scheme which has been agreed by Council is to be put into operation in 1953 and it will be necessary to make some slight amendments to the by-laws. This should be done before July and a special general meeting may have to be convened to approve the change.

The Accounts for 1951 reflect the increasing cost of the Institute publications, due mainly to the increased costs of paper and printing. It was agreed that these costs must be kept under constant survey and Council approved a suggestion that the chairman of the Finance Committee should be a member of the Circulation and Costs Sub-Committee of Publications Committee.

The question of IP representation on BSI committees was discussed. It is the practice of the BSI to approach the Institute to nominate oil company representatives on their committees rather than to go to the oil companies direct. These committees are always arranged so that all interests concerned are equally well represented, and the fact that the IP representatives are always drawn from the oil companies is due to the fact that the BSI themselves arrange for the attendance of the other interested parties. The Institute, in future, is to ask its representatives on these committees to submit an annual report on their activities.

A number of constitutional matters were discussed concerned mainly with the broadening of the basis of the Institute. These will be the subject of further discussions and will be reported upon later.

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DIRECTORY OF WALES AND MONMOUTHSHIRE

The second edition of the *Industrial Directory of Wales and Monmouthshire** a useful volume of 338 pages, has recently appeared. The section in which products and services are classified alphabetically is followed by a directory of names and addresses in which details of products are also included.

A number of executives of the principal industries have contributed articles describing progress in their particular field. Among these is R. B. Southall, director and general manager of National Oil Refinery, Llandarcy, who, in his capacity of president of the Industrial Association of Wales and Monmouthshire, also contributed a Foreword.

*From Aberdare House, Mount Stuart Square, Cardiff, 10s 6d. a copy.

BUTANE SUPPLIES TOWN WITH GAS

Whitland, Carmarthenshire, is the first town in Britain whose town's gas consumers have been supplied with butane in place of coal gas. The liquid butane is supplied in high-pressure containers by AIOC's Llandarcy refinery.

On the first day of the new scheme, the butane-air plant made enough gas for a normal 24-hour supply at Whitland in 3 hours, compared with the usual 18 hours per day operation of the coal gas plant.

During a year, according to Mr T. Mervyn Jones, Chairman of the Wales Gas Board, 70 tons of butane will be required for Whitland's gas supply instead of the 538 tons of coal normally used, and it was estimated that the new process would not involve increased manufacturing costs.

THE COUNCIL AND OFFICERS OF THE INSTITUTE 1952-3

H. S. Gibson

The nomination of Mr **H. S. Gibson**, C.B.E., M.A., M.I.Mech.E., as President of the Institute for the Session 1952-3 was unanimously approved at the Annual General Meeting on April 24.

Mr Gibson, who joined the Institute in 1928, became a Member of Council in 1949. In 1947 he was awarded the Redwood Medal and delivered the Redwood Lecture on "The Production of Oil from the fields of South-West Iran". In the same year he was awarded the C.B.E.

After demobilization in 1919 following service in the 1st Bn York and Lancaster Regiment in France, Egypt, Salonika, and Turkey, he went to Emmanuel College, Cambridge, taking his Mechanical Science Tripos in 1922 and proceeding to M.A. in 1930.

On leaving Cambridge, Mr Gibson entered the service of the (then) Anglo-Persian Oil Company as production engineer, becoming production superintendent in 1928, and production manager in 1930. In 1932, he was made assistant fields manager (production), in 1944 assistant general fields manager (production), and in 1945 general fields manager.

Returning to England in 1949, H. S. Gibson took charge of the Anglo-Iranian Oil Company's research station at Kirklington Hall and on January 1, 1950, was appointed to his present position of managing director of the Iraq Petroleum Company Ltd. and associated companies. In this capacity he has been responsible for the negotiations with the Iraq Government which led to the recent agreement in regard to the exploitation of the immense oil resources of Iraq.

VICE-PRESIDENTS

At the Annual General Meeting three new vice-presidents were also nominated by the Council and were approved without dissent. They are.

H. Hyams

H. Hyams, who was previously a vice-president for the period 1948-50, has been a very active Member of Council since 1944, particularly in the field of laboratory test methods and oil measurement standardization. As Chairman of the Oil Measurement and Sampling Sub-Committee, he was the inspiration behind the three volumes of petroleum measurement tables which are now in the course of preparation and which are to be published jointly by IP and ASTM. Also, he is mainly responsible for the new IP "Petroleum Measurement Manual" which is shortly to be published.

Mr Hyams is also a keen exponent of the desirability of promoting closer co-operation with the ASTM on standardization matters and is chairman of the Institute's ASTM/IP Co-ordination Committee. Twice, in 1945 and in

1950, he visited the U.S.A. for the particular purpose of developing and finalizing details of the ASTM/IP tables and in the interests of international understanding in petroleum standardization matters.

As a Member of Council of the Institute, Harry Hyams has always given willingly of his services. Thus, he is chairman of the Finance Committee, deputy-chairman of the Nomenclature Sub-Committee and serves also on the following committees: Branches, By-Laws, Standardization, House, Publications and its Circulation & Costs and Library Sub-Committees. During the Third World Petroleum Congress, Mr Hyams was a member of the British National Committee and chairman of the Oil Measurement and Sampling Section at the Congress, to which Section he presented two papers.

During his 33 years with the Shell organization, Mr Hyams' activities have involved him in senior responsibilities relating to such matters as standardization, laboratories and laboratory equipment, oil measurement and loss control, library and technical information, and office management.

H. E. F. Pracy

H. E. F. Pracy, B.A.,M.I.Chem.E., a member of the Institute since 1933, a Member of Council since 1947 and chairman of the Stanlow Branch 1945-8. He also serves on the Branches, Election, Finance, and Publications committees. Since 1948, "Harry" has acted as liaison between overseas members and the Institute.

Educated at Christ's Hospital and at Christ's College, Cambridge, he spent twelve years in the explosives and dyestuffs industries, joining the Shell Group in 1927. In "Shell" he has been always on the refining side, first at Miri, Sarawak, then from 1933 in Trinidad as refinery manager, and from 1941 in the U.K. at Shell Haven, at Stanlow, and now at Heysham as Refinery Manager for "Shell" and General Manager of Trimpell Ltd., the 50-50 I.C.I/Shell company.

Harry Pracy has played most games, but now limits his activities to golf and bridge, his other interests being music, the theatre, and literature.

R. B. Southall

R. B. Southall, who has been a member of the Institute since 1925, a Member of Council since 1946 and was chairman of the South Wales Branch from 1944-8, also serves on Branches, Election, Engineering, and Finance committees.

Mr Southall has been a director of National Oil Refineries Ltd. since 1950, a company which he first joined in 1921. In 1936, he was appointed assistant refinery superintendent, becoming refinery superintendent in the following year. In 1943, he became general manager.

Keenly interested in local education affairs, R. B. Southall has been a Council Member of Swansea University since 1948 and in the years 1947, 1948, and 1950 was a U.K. Employers' Delegate to the ILO Petroleum Committee. He is also 1951-2 president of the Industrial Association of Wales and Monmouthshire.

Council

Resulting from the ballot, 10 new Members of Council were elected, 6 being retiring vice-presidents or members standing for re-election and 4

being new members. Those declared elected by the ballot are:

Re-elected members:

V. Biske, LL.M., B.Sc., F.R.I.C.
C. D. Brewer, M.I.Mech.E.
E. J. Dunstan, M.Sc., M.I.Chem.E.
F. L. Garton, M.A., B.Sc.
J. A. Oriel, C.B.E., M.C., M.A., B.Sc., F.R.I.C.
J. S. Parker, M.A., B.Sc.

New members:

A. J. Goodfellow, B.Sc., A.R.I.C.
E. C. Masterson, B.Sc.
A. R. Stark, B.Sc., A.R.I.C.
W. H. Thomas, A.R.S.M., F.R.I.C.

The Vice-Presidents and Council for 1952-3 are thus as follows:

Vice-Presidents:

E. B. Evans, Ph.D., M.Sc., F.R.I.C. (Esso Development Co. Ltd.).
H. Hyams (Shell Petroleum Co. Ltd.).
F. Morton, Ph.D., F.R.I.C. (University of Birmingham).
H. E. F. Pracy, B.A., M.I.Chem.E. (Trimpell Ltd.).
R. B. Southall (National Oil Refineries Ltd.).
H. C. Tett, B.Sc., D.I.C. (Esso Petroleum Co. Ltd.).

Council:

W. S. Ault, B.A. (Sheli-Mex & B.P. Ltd.).
V. Biske, B.Sc., LL.M., F.R.I.C. (Lobitos Oilfields Ltd.).
C. D. Brewer, M.I.Mech.E. ("Shell" Refining & Marketing Co. Ltd.).
E. J. Dunstan, M.Sc., M.I.Chem.E. (Manchester Oil Refinery Ltd.).
F. L. Garton, M.A., B.Sc. (Shell Petroleum Co. Ltd.).
A. J. Goodfellow, B.Sc., A.R.I.C. (Carless, Capel & Leonard Ltd.).
J. G. Hancock ("Shell" Refining & Marketing Co. Ltd.).
E. LeQ. Herbert, B.Sc., F.R.I.C. ("Shell" Refining & Marketing Co. Ltd.).
E. C. Masterson, B.Sc. (Kuwait Oil Co. Ltd.).
J. A. Oriel, C.B.E., M.C., M.A., B.Sc., F.R.I.C. (Shell Petroleum Co. Ltd.).
J. S. Parker, M.A., B.Sc. (Lobitos Oilfields Ltd.).
D. L. Samuel, B.Sc., A.R.I.C. (Shell Petroleum Co. Ltd.).
G. H. Smith, Ph.D. (Scottish Oils Ltd.).
A. R. Stark, B.Sc., A.R.I.C. (Anglo-Iranian Oil Co. Ltd.).
E. J. Sturgess, B.Sc. (Shell Petroleum Co. Ltd.).
W. H. Thomas, A.R.S.M., F.R.I.C. (Anglo-Iranian Oil Co. Ltd.).
O. F. Thompson, O.B.E. (Shell Petroleum Co. Ltd.).
G. H. Thornley, M.Sc. (C. C. Wakefield & Co. Ltd.).
H. de Wilde, M.Sc., M.I.Mech.E. (Shell Petroleum Co. Ltd.).
A. T. Wilford, B.Sc., F.R.I.C. (London Transport Executive).
C. S. Windebank, B.Sc., M.S. (Esso Development Co. Ltd.).

Ex-Officio Members of Council

The following were elected as *ex-officio* Members of Council to represent the Branches:

I. McCallum	(*Fawley*)
A. W. Deller	(*London*)
H. H. Ballard	(*Northern*)
W. M. Stirling	(*Scottish*)
E. J. Horley	(*South Wales*)
J. C. Cragg	(*Stanlow*)

Honorary Officers

G. H. Coxon (Anglo-Iranian Oil Co. Ltd.) and **C. Chilvers,** B.Sc., F.R.I.C. (Esso Petroleum Co. Ltd.), were unanimously re-elected as honorary treasurer and honorary secretary respectively.

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P. C. POPE

It is with regret that we record the death on March 1 of P. C. Pope, secretary of the Institute of Fuel from September 1927 until six years ago. Mr Pope was a well-known figure in the fuel industry and was one of the prime movers in the merger of the Institution of Fuel Economy Engineers and the Institution of Fuel Technologists as the Institute of Fuel in July 1927.

On his retirement from the secretaryship, the distinction of Honorary Member of the Institute of Fuel was conferred upon him and for a time he acted as an adviser to the Council.

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Lake District Map. A pictorial map (size $16\frac{1}{2} \times 9\frac{1}{2}$ inches) of the Lakelands has been issued by Shell-Mex and B.P. Copies may be obtained free from Shell-Mex House, London, W.C.2, or at any of the company's divisional offices.

AROUND THE BRANCHES

Fawley Branch

The Fawley Branch met on March 19 at the Esso Recreation Club, Holbury. Dr F. Mayo was in the chair and introduced A. G. Taylor, the manager of Esso Petroleum Company's Inland Distribution Department, who spoke on "Distribution of petroleum".

Mr Taylor first reviewed the various methods available for inland distribution of petroleum products from the ocean terminals to the bulk plants and depots and from these to the customer. After a review of the U.K. pipeline system, which he stated was not in regular use as a means of distributing products for civilian purposes, he described briefly the use of barges. These have the advantages of carrying relatively large quantities but were only useful in a limited number of districts where suitable waterways are available. The largest proportion of petroleum was, therefore, distributed by road and rail tank wagon.

Mr Taylor described in some detail the development of road tank cars from the horse-drawn wooden barrel to the modern motor vehicle of 3600 gallons capacity. He detailed the legal requirements which must be met in constructing and operating such vehicles and suggested that for customer deliveries, as opposed to supplying inland depots from marine terminals, vehicles of less than maximum capacity had a number of advantages.

In the case of rail car distribution, the regulations are probably more exacting than for road vehicles, and Mr Taylor mentioned the prohibition of bottom outlets on spirit cars as an example. The present method of charging freight according to the value of the cargo rather than on a weight and distance basis is discouraging to the petroleum industry. Nevertheless, rail distribution, even over considerable distances, becomes attractive when existing facilities are such that rail delivery avoids double handling.

In replying to questions put to him at the close of the lecture, Mr Taylor clarified a number of technical points. He also expressed the opinion that 40-ton rail cars, such as are commonly used in the U.S., are not likely to become popular in the U.K.

The meeting closed with a vote of thanks by Dr A. W. Pearce.

Persian Gulf Branch

The inaugural meeting of this branch was held in the Hubara Club, Kuwait, on February 24, with 48 persons present. A first committee, consisting of six members from Kuwait and one from Bahrein, was elected: E. Boaden, V. J. Chir, G. A. Hogg, R. M. S. Owen, W. C. Renton, Jr., A. L. Smither, and R. Godfrey, the last-named being the member from Bahrein. Branch rules are being formulated by the Committee.

In an opening address, Captain D. Comins, chief petroleum engineer of the AIOC, said it was most gratifying to see so many Americans present, and expressed the hope that more non-technical members would join.

While the balloting for committee members was in progress, E. Boaden, superintendent of production operations in Kuwait, gave a talk entitled "The hard way", in which he gave a graphic description of oil production in Roumania in the 20's and 30's.

The meeting closed with a vote of thanks to the Chair, after which light refreshments were served in the Club.

South-Eastern Branch

A meeting of the South-Eastern Branch was held at the King's Head Hotel, Rochester, on April 1, 1952, when K. A. Spencer, B.Sc., A.M.I.Chem.E., A.M.C.T., presented a paper on "The elements of cathodic protection".

It was both interesting and alarming to hear from Mr Spencer that the authorities place the annual loss of steel by corrosion in Great Britain as £50,000,000. This is very difficult to realize and if such is the case the comparatively new science of cathodic protection will definitely come into its own in Great Britain, as a means of reducing the enormous wastage which occurs at a time when it can be ill afforded. Rapid strides have already been made in U.S. and Europe.

Mr Spencer described in simple terms the electro-chemical action which was the prime cause of corrosion in buried steel structures and he went on to describe the process of preventing this by means of applying a counter current.

A film was then presented which portrayed the laying and cathodic protecting of the Grangemouth-Finnart pipeline.

The meeting was then opened for discussion when questions were answered by Mr Spencer in a capable and humorous manner.

South Wales Branch

On March 6, a talk was given by S. Shaw of Calor Gas (Distributing) Co. Ltd., entitled "A general survey of liquid fuel gas, its distribution and uses". E. S. Squire, Branch chairman, was in the Chair.

Mr Shaw's talk, profusely illustrated with lantern slides and photographs, dealt with the methods of transportation from the very early days to the present time, thus indicating the amazing and almost incredible changes. He described the initial difficulties in persuading individuals to use liquid fuel gas, particularly in the domestic field, and gave figures showing the rapid spread in its use. He also described the system of distribution, how the United Kingdom was zoned with central distribution points to ensure that there would be no shortage of material in any area. The author went on to discuss the very numerous methods and means of using liquid gas and its application in both the domestic and industrial field.

An interesting discussion followed and a vote of thanks was proposed by T. F. Perry and seconded by W. C. Greaves.

Council Branches Committee at Llandarcy

The Branches Committee of the Council met in South Wales on March 21. During their visit, at the invitation of the Management of the National Oil Refineries Ltd., the visiting members of the Committee were taken on a tour of the Llandarcy Expansion Project, prior to which an explanatory talk was given by F. V. M. Bell, general superintendent of construction, National Oil Refineries Ltd.

The visitors, together with the members of the South Wales Branch Committee, were entertained to lunch by the National Oil Refineries Ltd., at the Caewern Hotel, Neath, where, subsequently, the visiting committee met.

In the evening the visitors took dinner with the members of the South Wales Branch, under the chairmanship of the Branch chairman, E. S. Squire; this quite informal function was held in the new staff canteen of the National Oil Refineries Ltd., a well-planned and delightfully spacious building, and the Branch takes pride in the fact that it will be on record that the Institute had the honour of holding the first function to take place in this building.

R. B. Southall (Council Member and South Wales Committee) in proposing the toast "Our Guests, coupled with the name of G. H. Thornley, chairman, Council Branches Committee", expressed some doubt about his own status since he had his feet in both camps, but assumed the role of host. He went on to say how pleasing it was to note that representatives from all the United Kingdom Branches were

present as well as Council Members; he also drew attention to the fact that the Institute was not an "all male" affair and that they had three lady members present. He concluded by urging local Branch members to seek Corporate membership. In his reply, Mr Thornley expressed thanks on behalf of the Committee and himself.

The Dinner was followed by an "Any Questions" session. The team, made up from the visitors who had kindly agreed to participate, consisting of Messrs. G. H. Thornley, Question-Master, H. Hyams (Council), H. E. F. Pracy (Council), N. E. F. Hitchcock (Chairman, London), I. McCallum (Secretary, Fawley), C. D. Brewer and V. Biske (Chairman and Secretary, Stanlow). The questions, which had been submitted by South Wales Branch members prior to the function, were in the main on Institute matters, and although it was obvious that there was some "background", they were handled by the team in a very able manner and not too seriously. It is safe to say that, as a result, the South Wales Branch members present—seventy in all—now have a better idea of the function of the Institute and of the aims and interests of other Branches.

The whole proceedings were enjoyed by all present and the South Wales Branch is very appreciative of the facilities made available to them by the National Oil Refineries Ltd.

The guests were Messrs. G. H. Thornley (Chairman, Branches Committee), H. Hyams (Council), H. E. F. Pracy (Council), G. H. Smith (Council and Scottish), H. H. Ballard (Chairman, Northern), C. D. Brewer and V. Biske (Chairman and Secretary, Stanlow), G. M. Davies (Secretary, Northern), D. Hammerton (Chairman, Birmingham), N. E. F. Hitchcock (Chairman, London), D. A. Hough (General Secretary), P. J. Jones (Secretary, Birmingham), F. Maliphant (Secretary, South-Eastern), I. McCallum (Secretary, Fawley), and H. G. Spence (Secretary, London).

Taken during the visit of the Council Branches committee to Llandarcy, this picture shows (left to right): T. F. Perry, D. A. Hough, V. Biske, J. A. Green, P. J. Jones (at back), H. G. Spence, C. D. Brewer, G. H. Smith, I. Cameron, P. F. Ellis (at back), F. Maliphant, D. W. Thomas (at back), G. M. Davies, C. A. Simpson, H. H. Ballard, D. Hammerton, G. H. Thornley, H. E. F. Pracy, E. S. Squire, R. B. Southall, F. V. M. Bell, N. E. F. Hitchcock, H. Hyams, E. J. Horley.

BIRMINGHAM STUDENTS' DINNER

(Left to right): L. G. Hanlon, S. Barratt, R. M. N. Molesworth, Sir Ewart Smith, J. E. Grew, Prof. F. H. Garner, Dr W. D. Scott, W. D. Reid.

"The technologist in Industry" was the theme of the fifth Annual Dinner of the Birmingham Chemical Engineering Society and the Student Section of the Institute of Petroleum held in Birmingham on March 18.

The chairman of the Society, J. E. Grew, presided over a gathering numbering over 150 and the guests at the top table were Sir Ewart Smith (*I.C.I. Ltd*), S. Barratt (*Messrs Albright & Wilson Ltd*), Dr W. D. Scott (*Monsanto Chemicals Ltd*), H. S. Gibson, C.B.E. (*president-elect of the IP*), E. LeQ. Herbert ("*Shell*" *Refining & Marketing Co Ltd*), and G. le B. Diamond (*West Midland Gas Board*). Many other guests were seated throughout the room and included L. N. Bevan (*president, Guild of Undergraduates*), J. Christian (*Trinidad Leaseholds Ltd*), V. P. King (*Bahrein Petroleum Co Ltd*), J. S. Parker (*Lobitos Oilfields Ltd*), and R. B. Southall (*National Oil Refineries Ltd*).

The Technologist in Industry

Prof. F. H. Garner, O.B.E., president of the Society, proposing this toast, said that at present we seem to suffer from an excess of planning, but a lot of trouble had been taken to get the facts and, as Mark Twain had said: "Let us first get the facts before we start to distort them".

Prof. F. Morton, H. S. Gibson, and R. B. Southall.

Many industry committees had visited America and all had reported that in the U.K. greater emphasis should be placed on the technologist in industry. The planner was an enemy to *ad hoc* procedure and this recalled one of Prof. Hildebrand's limericks entitled Vocational Guidance:

" I asked an old man of Bangkok
Who sat sunning himself on a rock,
What he planned for the future;
He replied: " If it suits yer,
I'll make my decision *ad hoc*".

This was appropriate since they were dealing with choice of profession, in which the *ad hoc* procedure must ultimately lead to some plan or choice of work in the future.

The subject of the toast, said Professor Garner, was of great importance in the present economic position of Britain. There must be some regrouping of those who concentrate in the narrow educational field of humanities without science, to the broader field of science, and particularly technology based on the humanities. Men who have been narrowly trained in the classics claim that this represents a broad education and sometimes look with contempt on the scientist and on the technologist.

The present position has, however, provided realization of its seriousness both from the economic point of view and from the aspect of the general welfare of Britain, concluded Professor Garner.

Sir Ewart Smith, in the course of his response to the toast, said that it was important that every man should find out for himself what his job should be and should then stick to it. He illustrated this by the story of the small Clyde steamer with a crew of two—captain cum navigator and the engineer. After some thirty years they tired of their jobs and changed roles. So, with the captain below and the engineer on the bridge, they sailed, but half an hour later, there was a frantic call from the engine room to the bridge: "For the Lord's sake, Mac, what shall I do, I canna keep up steam pressure"; back came the reply: "Dinna worrit, Sandy, we've been aground for the last twenty minutes".

Industry was becoming even more complex, said Sir Ewart, and it depended for its success not only on the application of scientific knowledge, but also on the efficiency of management. In the past, management had been considered an art, but the applica-

(Left to right): Prof. F. H. Garner, Dr W. D. Scott, B. Topley, S. Barratt, Sir Ewart Smith.

tion of scientific techniques in management itself was of ever-increasing importance. He suggested that those just starting out on an industrial career should actively seek a wide variety of experience and the maximum responsibility at each stage. They would thus learn to be comprehensive in their outlook, and could decide for themselves which form of activity attracted them most. It was the responsibility of management to see that the newcomers had the benefit of starting where he and his contemporaries were leaving off. Above all, they should appreciate that understanding was better than knowledge.

Industry was not merely a matter of applying technical knowledge to material things; it was very much a matter of people also. As specialization grew with the increase of scientific knowledge, it became even more important to train men for co-ordinating the specialist fields and for dealing with the human aspects of management.

From the time of the Industrial Revolution we had been living in an age dominated by engineering, but the period on which we were now entering may well be a chemical age, although this will not diminish the basic importance of engineering. The well-trained chemical engineer was, therefore, likely to have unlimited scope. Sir Ewart hoped that those entering the profession would be concerned with results rather than with prestige and that, in seeking the broad approach, they would avoid undue professional class consciousness. He advised them to take care in "choosing their boss" and at the interview not to worry about the impression they were themselves making.

He concluded by asking "What of the future?" It was clear that in Britain there was a big job to do if we were to live in comfort and security. The country depended on productive industry—and by that he meant the things which came out of the factories and out of the fields. The efficiency of industry depended primarily on good management and that, in turn, would depend on them as its future leaders.

J. B. Christian, O. O. Fernandes and Prof. F. Morton.

"*The Society*"

Dr W. D. Scott, during his proposal of the toast of "The Society", said that he thoroughly agreed with all that Sir Ewart Smith had said earlier. As members of a society they had a duty and responsibility to society. Their principal task as chemical engineers was to engage in a subject which he would call "communication", and whoever had the responsibility for communications was responsible for a function on which the continued existence or fall of our civilization depends. The concept was frightening.

In order to make his point, Dr Scott drew some technical analogies. It was their responsibility to take a laboratory idea and translate it into a commercial project benefiting mankind. Some would be engaged on research work, some on design, and some on production. But all would be engaged on interpreting information whether derived from technical or human sources. The manner in which they communicated that information would determine the means by which industry would progress and mankind survive.

The chemical engineer had an intellectual advantage over the other engineers. A chemical process was a process of change and their minds were therefore attuned to change. They

must also be prepared to adapt themselves to changes in human relationships as only by being as progressive in sociological advances as in technological advances could we hope for full understanding.

Dr Scott then touched on the tremendous potentialities of the new science of cybernetics. The petroleum industry had made big advances in the sphere of instrumentation, and the corollary of these developments was in the use of machines to perform functions once performed by the brain of man. These advances must alter our attitude to the use of manpower and we had to educate man to understand and accept this new power. We could only do so by accepting new definitions of education. Dr Scott concluded by quoting a definition of an educated man as "A man who is ready to recognize that he has not all the answers, has the skill of receiving communications from others and, having received the communication, knows how to act on it."

Sports are an important feature of university life and here chemical engineering students are in a trial for the 3-mile event.

Mr J. E. Grew, thanking Dr Scott for his remarks in proposing the toast, outlined the work of the Society during the year and included an interesting account of their successes in various sports.

"*The Guests*"

The toast of "The Guests" was proposed by Mr R. M. N. Molesworth, junior treasurer of the Society, and suitably replied to by Mr S. Barratt.

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CORRESPONDENCE

The Editor,
Institute of Petroleum Review.
Sir,

Some American petroleum journals have recently given publicity to a "new" method of controlling oil tank fires by agitation, said to have been developed by J. L. Risinger, of the Socony-Vacuum Oil Company Inc. As the American writers appear to be unacquainted with the work on the same subject already done in Great Britain, attention is drawn to the publication of J. H. Burgoyne and L. L. Katan in the *Journal of the Institute of Petroleum*, March 1947, p. 158, in which the principles and applications of the technique of agitation are examined in some detail. The experiments described were carried out on behalf of the Ministry of Home Security and the Department of Scientific and Industrial Research, at Imperial College, London, and at the Llandarcy installation of National Oil Refineries Ltd., during the years 1943 to 1946.

The desirability of extending the work of Burgoyne and Katan with experiments on the large scale has been stressed (see for example, *Oil*, 1950, I (9), 12) and the American tests are to be welcomed as a move in this direction. At the present stage, however, the technique of agitation can no longer be described as "new".

Yours faithfully,

J. H. BURGOYNE.

Imperial College of
Science and Technology,
Prince Consort Road,
London, S.W.7. April 8, 1952.

U.K. PETROL TAX 2s. 6d. PER GALLON

From March 11, 1952, the Customs and Excise duty on petrol and other light oils and on heavy oil used as road fuel was increased from 1s. 10½d. to 2s. 6d. per gallon. The preference on indigenous light and heavy oils used in road vehicles continues at 9d. per gallon.

Present price of motor spirit is 4s. 2¾d. per gallon and the new tax therefore represents 59 per cent of the total price to the consumer.

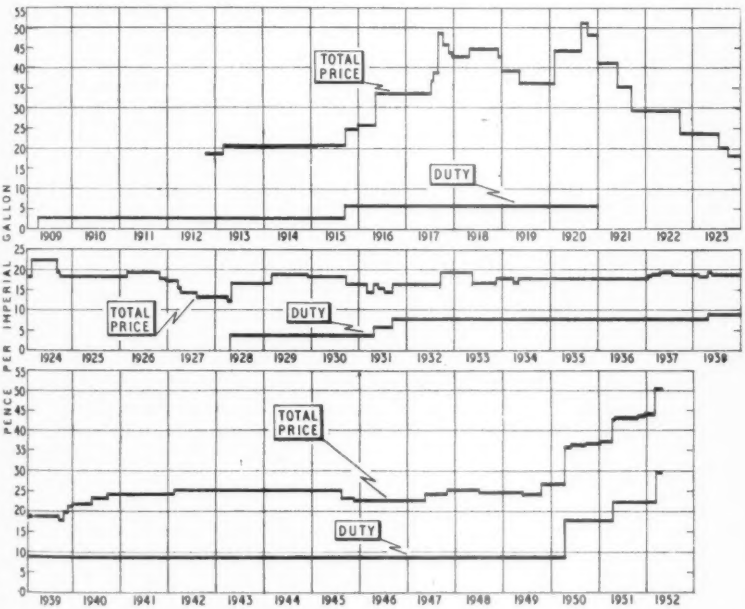
In announcing the increase in the tax in his budget speech, the Chancellor of the Exchequer said: "I have only one tax increase to propose and that is on oil. Since the main objective of the Budget is to relieve our balance of payments difficulties I must pay particular attention to a scarce product which costs us foreign exchange".

Previous Taxation

The motor fuel tax was first imposed in 1909 at 3d. per gallon, increased to 6d. in 1915, and repealed in 1921.

In 1928 the tax was reimposed at 4d. per gallon, and Mr Winston Churchill said: "The fruits of this tax are not required to pay for the ordinary expenses of governing the country. The whole yield, and more than the whole yield, will be devoted to the relief of other burdens." The object of the tax was then to finance the rating relief provisions of the Local Government Act, 1929.

In 1931 there were two increases, first to 6d. and then to 8d. Intro-



The above graph is based on London prices for premium grade spirit to September 3 1939 and then on Pool spirit. Up to 1926 can prices are given and then ex-pump prices. Prior to the first tax imposition in 1909 motor spirit was sold at 11d. per gallon and in 1911 was 1s. per gallon including duty. The price details were supplied by the courtesy of Shell-Mex & B.P. Ltd.

ducing the first increase, Mr Philip Snowden said: "I have never liked the oil duty . . . but I find the tax in existence and fruitful in its yield . . . I should regard this addition of 2d. as having a claim for remission when we are in a position to remit taxation".

Until 1938 the tax remained at 8d. and was then raised to 9d. until 1950, when Sir Stafford Cripps doubled it to 1s. 6d. and said:"The time has come when some other automatic means of restricting consumption of petrol such, for instance, as the shortage of vehicles, are disappearing, so that fiscal inducements to economy have become necessary".

There was an increase to 1s. 10½d. in 1951 and in January 1952 Mr Butler, explaining why the Government did not propose to reintroduce petrol rationing, said:"Only about one-quarter of the total consumption of petroleum products consists of motor spirit. A good deal less than half the consumption of motor spirit is by private motorists, and not very much of this is used for pleasure motoring".

* * *

PERSONAL NOTES

C. T. Brunner, F.Inst.Pet., director and general manager of Shell-Mex and B.P. Ltd., has been elected president of the Institute of Transport for 1952-3. He will assume office on October 1.

F. A. C. Guépin has been appointed a director of Shell-Mex and B.P. Ltd., and of Scottish Oils and Shell-Mex Ltd., in succession to the Hon. F. J. Hopwood. Joining the Royal Dutch/Shell group in 1929, Mr Guépin began his career in Roumania. After service in England, and other European countries, he went to the United States in 1937, becoming Shell's senior vice-president at head office in New York three years later. He returned to London in 1944.

S. G. Jarvis, formerly assistant secretary of C. C. Wakefield & Co. Ltd., has been appointed secretary of the company. Mr Jarvis, who is 42, joined Wakefields in 1925 and served in a number of departments at head office.

Dr Carlos Pérez de la Cova, F.Inst.Pet., formerly Minister Counsellor of the Venezuelan Embassy in London, is now at his country's Embassy in Washington as Minister Counsellor for Petroleum. Dr Pérez de la Cova, who graduated from the University of Tulsa as a petroleum engineer, was a member of the Venezuelan Delegation at the Third World Petroleum Congress.

We regret to record the death on February 22 of **Morris W. Kellogg,** founder and chairman of the board of The M.W. Kellogg Company. Mr Kellogg started the company in 1901 as a small pipe fabricating shop in Jersey City.

H. Hyams, F.Inst.Pet., will be going to New York in early June to attend the meeting of the Petroleum Products Committee (TC28) of the International Organization for Standardization. He will be representing Great Britain through the BSI and will also be introducing standardizing material relating to petroleum test methods and oil measurement on behalf of the IP.

Following this meeting, Mr Hyams will attend meetings in New York of ASTM Committee D2 (Petroleum Products), of which he is a member.

LUBRICANT RESEARCH AT THORNTON

Recently editors of the technical press were guests of Shell-Mex and B.P. Ltd., at the Thornton Research Centre of the Shell Group. A special train conveyed the party from London, and on arrival at Stanlow and Thornton Station, coaches conveyed the guests via the Stanlow refineries to the Centre. Here they were welcomed by Dr C. G. Williams, F.Inst.Pet., director of research, who explained that Thornton Research Centre was one of the Shell Group laboratories located in various parts of the world, each of which served a special function. The function of Thornton was essentially that of application research in the endeavour to improve the service given by the products obtained from petroleum.

The particular aspect to which attention was directed on this occasion was that of the development of lubricants. Following the work of the chemist came the first tests in a single-cylinder engine, of which there were 30 or 40 at Thornton. Then, as development proceeded, tests were made in full-scale engines on the bench, and finally the lubricant was tested under service conditions on the road in a variety of vehicles.

At Thornton, said Dr Williams, the full range of petroleum products was investigated—from gas turbine fuels for jet aircraft and other purposes to bitumen for roads. In connexion with the development and use of chemicals from petroleum he mentioned that a complete laundry was available for the testing of detergents under actual usage.

Total staff was about 850, of which about 150 were university graduates in chemistry or physics. It was of interest to note that for every man engaged in research at least one was employed on support work—apparatus makers, librarians, administrators, etc.

Mr C. M. Vignoles, managing director of Shell-Mex and B.P. Ltd., then announced that the company was about to place on the British market a new motor lubricant—X.100—which had been made possible by the fundamental and practical research work and tests carried out at Thornton.

A method of evaluating the performance of lubricating oils for piston ring wear by means of radio-active tracers is being used at Thornton. Here the top piston ring, which has been rendered radio-active at Harwell, is being placed in position by means of a long-handled ring expander on a Petter s/c water-cooled engine. Amount of wear products in the oil samples taken periodically is determined by the degree of radio-activity recorded by a Geiger counter.

The visitors were then conducted around those parts of the Centre devoted to the development and testing of lubricants. Examples were shown of the work of the chemist and the physicist in the investigation of basic principles, various types of single-cylinder engines used in screening tests, the multi-cylinder engines in which more arduous working conditions are reproduced, gear and bearing testing machines, and a host of other testing machines for gear and bearing lubricant testing.

U.K. PETROLEUM TRADE IN 1951

By GEORGE SELL (Fellow)

Crude petroleum imports into the United Kingdom in 1951 reached the record total of 4,344,838,000 gallons, an increase of 83.4 per cent over the 1950 total. In comparison the imports of refined products were 0.5 per cent lower in total at 2,685,001,000 gallons. Noteworthy decreases in imports of refined products were motor spirit (14.3 per cent or 174,134,000 gallons less than in 1950), and lubricating oil (5.7 per cent or 6,762,000 gallons less), but it is also noted that the import of kerosine was increased by 31.2 per cent to 511,445,000 gallons.

In Table I details are given of the U.K. petroleum imports which have been extracted from the official return* and the Table also includes data regarding non-liquid products. Thus, it is seen that imports of paraffin wax were almost doubled. As regards mineral jelly, carbon black, and natural asphalt there were no significant changes between the two years.

Table II sets out the imports of petroleum during the last four years on a percentage basis. The trends shown in this Table are an indication of the effect of refinery expansion in the U.K. Thus, imports of crude oil have steadily gone up from 25.2 per cent in 1948 to 61.8 per cent in 1951, while there are equally notable decreases for refined products—motor spirit from

* "Accounts relating to trade and navigation of the United Kingdom, December, 1951." H.M.S.O., London.

TABLE II

PERCENTAGE IMPORTS OF PETROLEUM INTO THE U.K.

	1951	1950	1949	1948
	Per cent			
Crude petroleum	61.8	46.8	33.2	25.2
Motor spirit	14.8	24.0	28.8	25.4
Other spirit	0.7	0.6	0.7	0.6
Kerosine	7.4	7.6	9.3	8.7
Lubricating oil	1.6	2.4	1.5	1.9
Gas oil	5.6	7.3	9.8	10.2
Fuel and diesel oils	8.1	11.3	16.7	28.0
	100.0	100.0	100.0	100.0

TABLE I

QUANTITY AND VALUE OF U.K. PETROLEUM IMPORTS

	1951		1950		1949	
	Quantity 1,000 *gal*	*Value* £	*Quantity* 1,000 *gal*	*Value* £	*Quantity* 1,000 *gal*	*Value* £
Crude petroleum	4,344,838	160,467,606	2,369,258	74,256,473	1,546,243	40,174,686
Motor spirit	1,042,874	59,240,038	1,217,008	59,310,668	1,341,151	53,456,922
Other spirit	51,427	3,134,705	30,255	1,686,440	30,638	1,359,918
Kerosine	511,445	25,550,402	389,836	17,360,195	433,704	15,425,900
Lubricating Oil	112,411	14,306,403	119,173	10,131,667	72,749	5,176,984
Gas oil	395,843	19,043,315	369,165	15,201,956	457,881	14,859,775
Fuel and diesel oils	570,458	19,662,056	572,965	15,112,813	776,242	16,426,646
Other sorts	543	124,862	954	436,579	118	35,749
Total refined products	2,685,001	141,061,781	2,699,356	119,240,318	3,112,483	106 741,894
GRAND TOTAL	7,029,839	301,529,387	5,068,614	193,496,791	4,658,726	146,916,580
	Cwt.		*Cwt.*		*Cwt.*	
Paraffin wax	1,175,434	4,496,162	596,984	1,860,268	362,523	899,650
Mineral jelly	212,581	687,048	179,759	436,536	162,888	335,159
Carbon black from natural gas	886,760	4,065,020	867,110	3,596,426	562,447	1,981,810
Natural asphalt and bitumen	*Tons* 58,005	692,979	*Tons* 54,653	552,611	*Tons* 49,765	487,757

TABLE III

AVERAGE C.I.F. UNIT VALUES OF U.K. PETROLEUM IMPORTS

	1951	1950	1949
	£ *per* 1,000 *gal*		
Crude petroleum	36.93	31.35	25.98
Motor spirit	56.80	44.62	39.86
Other spirit	60.95	55.65	44.39
Kerosine	49.97	44.46	35.57
Lubricating oil	127.27	84.94	71.16
Gas oil	48.11	41.09	32.45
Fuel and diesel oils	34.47	25.89	21.15
Other sorts	229.95	456.80	302.96
Total refined products	52.54	44.04	34.30
	£ *per cwt.*		
Paraffin wax	3.83	3.29	2.48
Mineral jelly	3.23	2.43	2.06
Carbon black	4.58	4.15	3.52
	£ *per ton*		
Natural asphalt and bitumen	11.95	10.11	9.70

25.4 to 14.8 per cent, kerosine from 8.7 to 7.4 per cent, gas oil from 10.2 to 5.6 per cent, and fuel and diesel oils from 28.0 to 8.1 per cent.

C.I.F. Values

The trend to higher unit values of petroleum imports into the U.K. is shown in Table III, from which it is seen that the unit value of all oils except "other sorts" increased considerably. The highest increase from 1950 to 1951 was for lubricating oil—nearly 50 per cent—and fuel and diesel oils

TABLE IV

COUNTRIES CONSIGNING PETROLEUM TO THE U.K.

Country and Product	1951	1950	1949
	Thousand gallons		
BAHREIN, KUWAIT, QATAR, & TRUCIAL OMAN:			
Crude petroleum	2,233,608	931,252	531,883
Motor spirit	59,726	91,595	74,663
Kerosine	11,572	14,823	16,008
Gas oil	29,205	33,820	25,000
	2,334,111	1,071,490	647,554
BRITISH WEST INDIES:			
Motor spirit	54,649	66,508	68,866
Kerosine	53,917	40,255	44,251
Gas oil	26,132	16,567	18,083
Fuel and diesel oils	46,949	52,899	74,155
	181,647	176,229	205,355
OTHER COMMONWEALTH COUNTRIES & THE IRISH REPUBLIC:			
Crude petroleum	29,775	9,065	—
Motor spirit	33	—	51
Lubricating oil	26	19	50
Gas oil	12	201	4
Fuel and diesel oils	25,913	5,874	5,300
	55,759	15,159	5,405

TABLE IV—*continued*

NETHERLANDS ANTILLES:			
Crude petroleum	282,999	278,916	219,839
Motor spirit	408,788	390,106	509,349
Kerosine	264,128	194,956	224,198
Lubricating oil	17,555	20,623	9,875
Gas oil	42,715	49,173	118,494
Fuel and diesel oils	227,003	76,413	186,408
	1,243,188	1,010,187	1,268,163
SAUDI ARABIA:			
Crude petroleum	1,036,173	278,508	223,984
PERSIA:			
Crude petroleum	436,425	606,742	333,161
Motor spirit	36,000	242,416	227,976
Kerosine	80,784	129,266	133,059
Gas oil	—	6,106	32,594
Fuel and diesel oils	138,722	273,043	384,282
	691,931	1,257,573	1,111,072
UNITED STATES OF AMERICA:			
Crude petroleum	25,593	19,827	12,965
Motor spirit	237,637	77,377	296,697
Kerosine	66,092	7,299	5,700
Lubricating oil	88,484	94,527	62,680
Gas oil	105,782	39,454	93,786
	523,588	238,484	471,828
VENEZUELA:			
Crude petroleum	107,496	74,524	63,104
Motor spirit	137,408	205,154	48,809
Gas oil	116,056	102,311	50,183
	360,960	381,989	162,096
IRAQ:			
Crude petroleum	144,665	126,872	122,603
NETHERLANDS:			
Motor spirit	72,468	95,297	41,720
Gas oil	14,719	40,491	11,924
Fuel and diesel oils	47,847	146,314	58,557
	135,034	282,102	112,201
FRANCE:			
Motor spirit	24,207	39,978	28,752
Gas oil	43,855	54,657	54,260
	68,062	94,635	83,012
PERU:			
Crude petroleum	36,031	37,858	37,124
MEXICO:			
Gas oil	17,326	26,354	28,542
INDONESIA:*			
Motor spirit	—	7,609	24,340
*Includes Netherlands New Guinea in 1949.			
GERMANY:			
Fuel and diesel oils	—	5,630	14,266
OTHER FOREIGN COUNTRIES:			
Crude petroleum	12,073	5,694	1,580
Motor spirit	11,958	968	19,928
Kerosine	34,952	3,237	10,488
Lubricating oil	6,346	4,004	144
Gas oil	41	31	25,011
Fuel and diesel oils	84,024	12,792	53,274
	149,394	26,726	110,425

were 33.1 per cent and motor spirit 27.3 per cent higher in cost. The unit value of crude petroleum rose by 17.8 per cent.

Consigning Countries

Such details as are available in the preliminary return as to consigning countries, not necessarily the country of origin of the import, are given in Table IV.

The order of importance of the leading consignors in 1951—Bahrein, etc., Netherlands Antilles, Saudi Arabia, Persia, U.S.A., Venezuela—is of interest in comparison with 1950, when it was Persia, Netherlands Antilles, Bahrein, etc., Venezuela, Netherlands, Saudi Arabia, U.S.A.

It is of interest to note that 36.6 per cent of the total import of crude petroleum and refined products came from countries classified under "Commonwealth Countries", this group including mandated territories.

In Table V, the total imports have been arranged by zones according to the location of the consigning countries. The ever-increasing importance of the Middle East is striking and it would appear that in comparison with 1950 the increase has resulted in a considerable decline in the Caribbean total. It is of special interest to record that nearly 97 per cent of the crude petroleum imported into the U.K. in 1951 came from countries of the Middle East.

Re-Exports

Details of re-exports of imported oils are given in Table VI, the quantity being nearly 21 per cent higher in 1951 than in 1950 and the value 67.3 per cent higher. Fuel oil supplied as bunkers to ships engaged in the foreign trade (including fishing vessels) again established a new record with an increase of 33.4 per cent over 1950.

TABLE VI

U.K. RE-EXPORTS OF IMPORTED PETROLEUM

	1951	1950	1949
	Thousand gallons		
Motor Spirit	20,106	12,087	13,897
Kerosine	4,069	3,417	3,766
Lubricating oil	2,283	2,087	1,542
Fuel and diesel oils	1,531	4,784	3,374
All other sorts	4,045	4,157	4,953
Total	32,034	26,532	27,532
Value	£2,263,554	£1,352,638	£1,324,500
	Thousand gallons		
Oil fuel shipped for use in steamers	699,580	525,895	479,492

Exports

Total exports of U.K. home produced oils in 1951 was nearly three times as much as in 1950, the figures in Table VII showing that the increase was 185 per cent, the corresponding increase in value being 135.3 per cent. These increases have been recorded over several years. Comparative unit values in £ per 1000 gallons are: motor spirit, £53 (£47.47 in 1950); kerosine, £49.5 (£45.9); lubricating oil, £175.8 (£165.08); gas oil, £43.2 (£38.3); diesel oil, £36.9 (£32.1); fuel oil, £26.3 (£24.3); all other sorts, £74.1 (£119.6).

TABLE V

U.K. PETROLEUM IMPORTS BY ZONES OF CONSIGNMENT

	1951		1950		1949	
	1,000 *gal*	% *of total*	1,000 *gal*	% *of total*	1,000 *gal*	% *of total*
Middle East	4,206,880	59.8	2,734,443	53.9	2,105,213	45.2
Caribbean and Peru	1,821,826	25.9	1,606,263	31.7	1,672,738	35.9
U.S.A. and Mexico	540,914	7.7	264,838	5.2	500,370	10.7
Europe	203,096	2.9	382,367	7.6	209,479	4.5
Other and undisclosed areas	257,123	3.7	80,703	1.6	170,926	3.7

TABLE VII

U.K. EXPORTS OF HOME-PRODUCED AND HOME-MANUFACTURED PETROLEUM

	1951		1950		1949	
	Quantity 1,000 *gal*	*Value* £	*Quantity* 1,000 *gal*	*Value* £	*Quantity* 1,000 *gal*	*Value* £
Motor spirit	35,503	1,882,084	29,368	1,394,049	16,113	626,028
Kerosine	10,599	525,216	7,808	357,979	4,708	191,983
Lubricating oil	43,018	7,560,608	30,925	5,105,119	30,076	4,619,013
Gas oil	39,288	1,697,671	19,390	743,473	8,928	300,587
Diesel oil	76,910	2,832,327	35,989	1,155,738	5,114	139,781
Fuel oil	555,805	14,612,487	143,763	3,487,811	34,494	770,667
All other sorts	13,906	1,031,003	4,715	564,078	1,765	225,814
Total	775,029	30,141,396	271,958	12,808,247	101,198	6,873,873
	Cwt		*Cwt*		*Cwt*	
Lubricating compounds	341,331	1,250,323	233,306	742,510	163,745	496,424
Paraffin wax	—	—	55,799	155,610	33,070	122,375
	Tons		*Tons*		*Tons*	
Manufactured bituminous asphalt and emulsions	75,611	1,323,606	66,650	1,064,717	50,587	707,425

★ ★ ★

PETROLEUM IN PARLIAMENT

Re-refined Lubricating Oils

Asked what amount of waste lubricating oil was re-refined in 1951 and what would be the dollar cost of an equivalent import, the Minister of Fuel and Power said in a written answer (March 17): excluding re-refining on commission, 12,000 tons and 1 million dollars respectively.

Oil Refinery, Hampshire

No application had yet been submitted for planning permission for a site for a second refinery in Hampshire, said the Minister of Housing and Local Government in a written reply (March 25).

★ ★ ★

KARACHI REFINERY

The Burmah Oil Co. announced on March 23 that it has offered to put up an oil refinery at Karachi. The capacity contemplated is believed to be about 140 million gallons per annum and the cost would probably be of the order of 70 million rupees.

FROM WELL TO TANK

In an interesting BBC broadcast on April 8, Stirling Moss, the well-known racing motorist, was the questioner and Mr C. A. P. Southwell, president of the Institute of Petroleum, supplied the answers in an hour's programme describing the petroleum industry. In order to illustrate the points made by Mr Southwell, listeners were taken to Formby in Lancashire for an account of well drilling, to Shell Haven to hear about tanker transport, to Fawley for a description of some refining processes and plant, to Kuwait for a chat on life in a Middle East oilfield, to Sunbury to hear something about research, and to Worcester for details of inland distribution. The programme was produced with the co-operation of the Petroleum Information Bureau.

★ ★ ★

Kelloggram issue No. 2, 1951 series, published by the M. W. Kellogg Co., 225 Broadway, New York 7, describes the company's laboratories in Jersey City. Details of some of the research behind new processes and products like fluid hydroforming and Kel-F are given.

This striking night-time photograph shows the Fawley refinery jetty on Southampton Water. With a total length of some 3,200 feet, the jetty is capable of accommodating four of the largest tankers yet built. The artificial lighting seen here is by Metropolitan-Vickers Electrical Co., who have provided approximately 3000 lighting units for use throughout the Fawley plant.

★ ★ ★

FUEL RESEARCH

In 1950 a Specialist Conference on Fuel Research, convened by the British Commonwealth Scientific Official Conference, was held in London and attended by delegates from all parts of the Commonwealth.

One session was devoted to the production of liquid fuels and it was recommended that additional basic research work on the synthesis of oil from coal should be carried out by Commonwealth countries. The full recommendations and a summary of the discussions are now available in the Report of the Conference (H.M.S.O. 16 pp, 9d net).

★ ★ ★

APPOINTMENTS VACANT

ESSO Petroleum Company Limited, Refinery Department, Fawley, Southampton, have the following staff vacancies:

A. *Assistant Technical Superintendent:* Assistant Superintendent required in the Technical Department. Duties will cover the direction and co-ordination of the work of the various Sections of this Department, including Planning of Refining Operations, Process Engineering and Laboratory functions. Candidates should have preferably a good degree in Chemical Engineering and some years' experience in the petroleum refining industry in a responsible technical capacity. The post calls for qualities of initiative, alertness and leadership.

B. *Process Engineering Supervisor:* required in the Technical Department to plan and co-ordinate the work of the various sections of this Department dealing with the problems of operation, design or modification of refining plant. Candidates should have a good degree, preferably in Chemical Engineering, with some years' experience of work carried out at a supervisory level in the petroleum or related industries and have a sound knowledge of refining operations.

C. *Distillation Section Head:* required in the Technical Department, to supervise the work of a group of up to six graduates, covering the operating problems relating to crude running, and plant modification or design in the same field. Candidates should have a good degree, preferably in Chemical Engineering, and experience in petroleum distillation or allied industries.

The above senior posts carry four figure salaries to the right men, appropriate to their responsibilities. The Company has an excellent and comprehensive Pension Scheme. Recreational facilities of all descriptions are available, in a pleasant rural area bordering Southampton Water.

Applications should be sent in writing to Employee Relations Superintendent at above address, giving, in confidence, details of age, qualifications, experience, availability, present salary and salary required.

ESSO Petroleum Company Limited, Refinery Department, Fawley, Southampton, have the following staff vacancies:

Mechanical Engineers: required in Mechanical Department for work of a practical nature involving the organization and planning of all maintenance and construction work in a section of the Refinery. Candidates should have a University degree and some relevant experience in the Petroleum or related industry is essential.

Mechanical Engineer: required in Technical Department for work in connection with operating problems on compressors and pumps as used in the Petroleum Industry. Experience in this field desirable, but not essential. Candidates should have a good honours degree in Mechanical Engineering.

Engineering Stores Asst. Supervisor: Candidates should have practical experience of engineering work and materials used in Refinery or similar process plant, with good organizing ability and be capable of co-ordinating and planning for maintenance requirements, providing for alternative materials if necessary. They should have a University degree (not necessarily in Mechanical Engineering).

Chemical Engineers and Chemists: There are several vacancies in the Technical Department with good prospects for Chemical Engineers and Chemists. Candidates should have good honours degrees, and experience in the Petroleum or allied industries would be an advantage.

All the above are regular posts, with salaries appropriate to age, qualifications and experience. There is an excellent and comprehensive Pension Scheme: recreational facilities of all descriptions are available in a pleasant rural area bordering Southampton Water.

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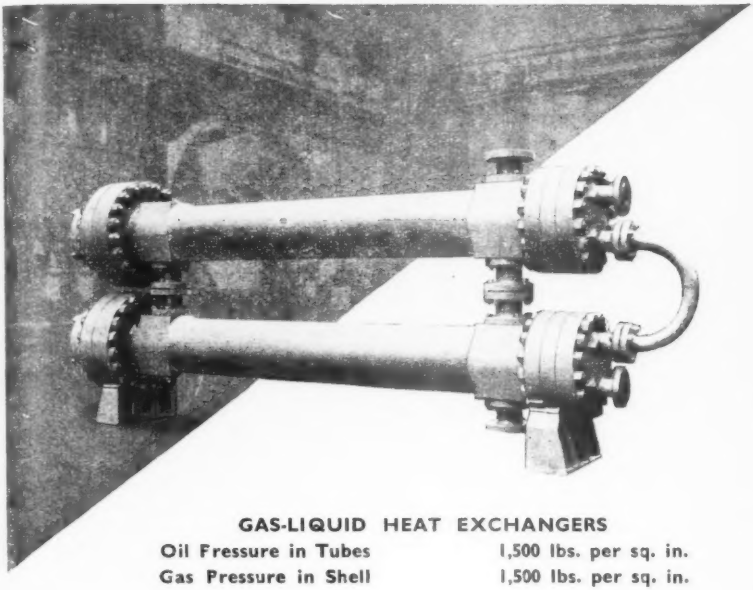

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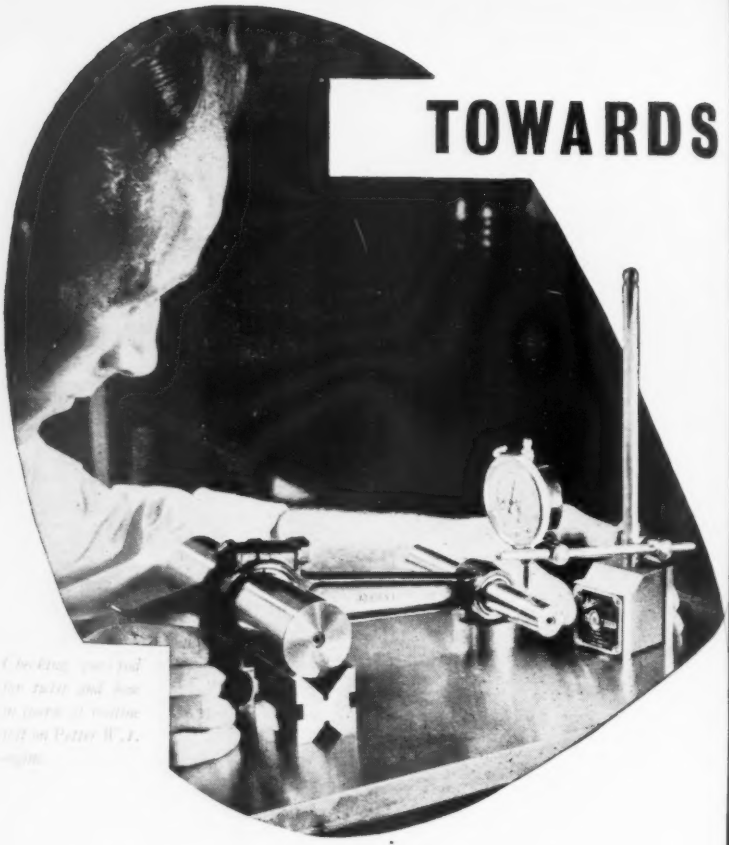

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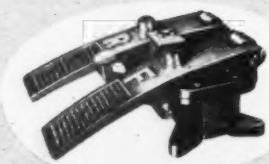

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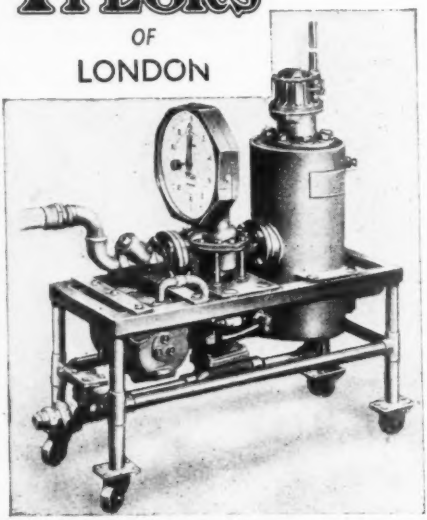

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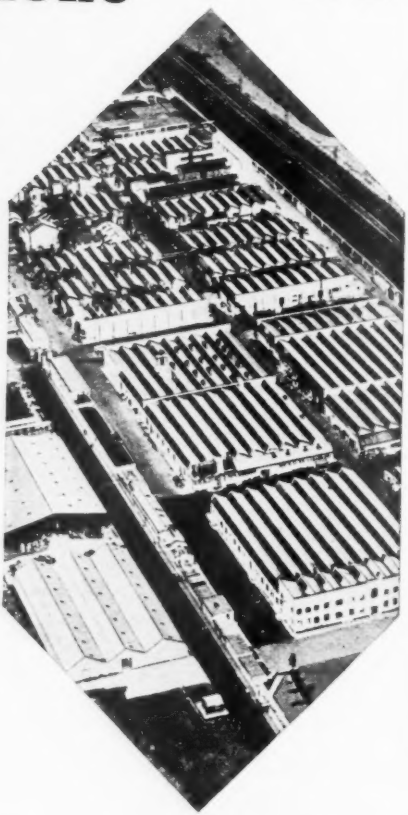

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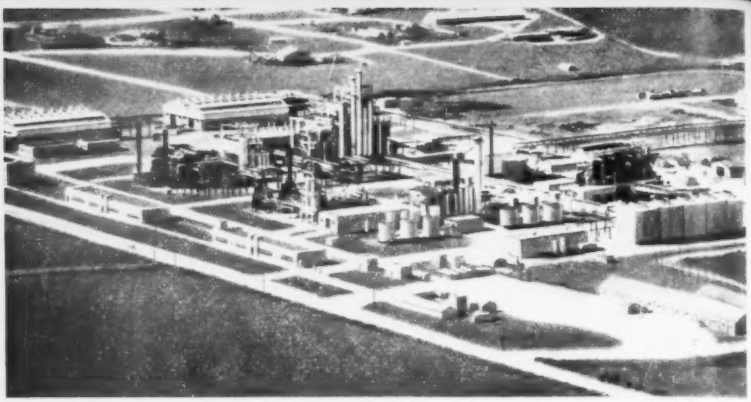

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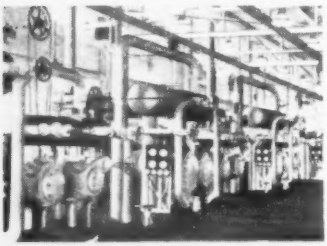

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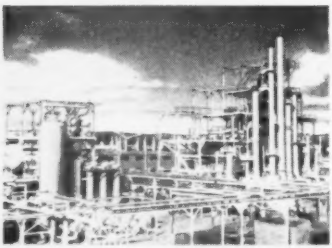

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